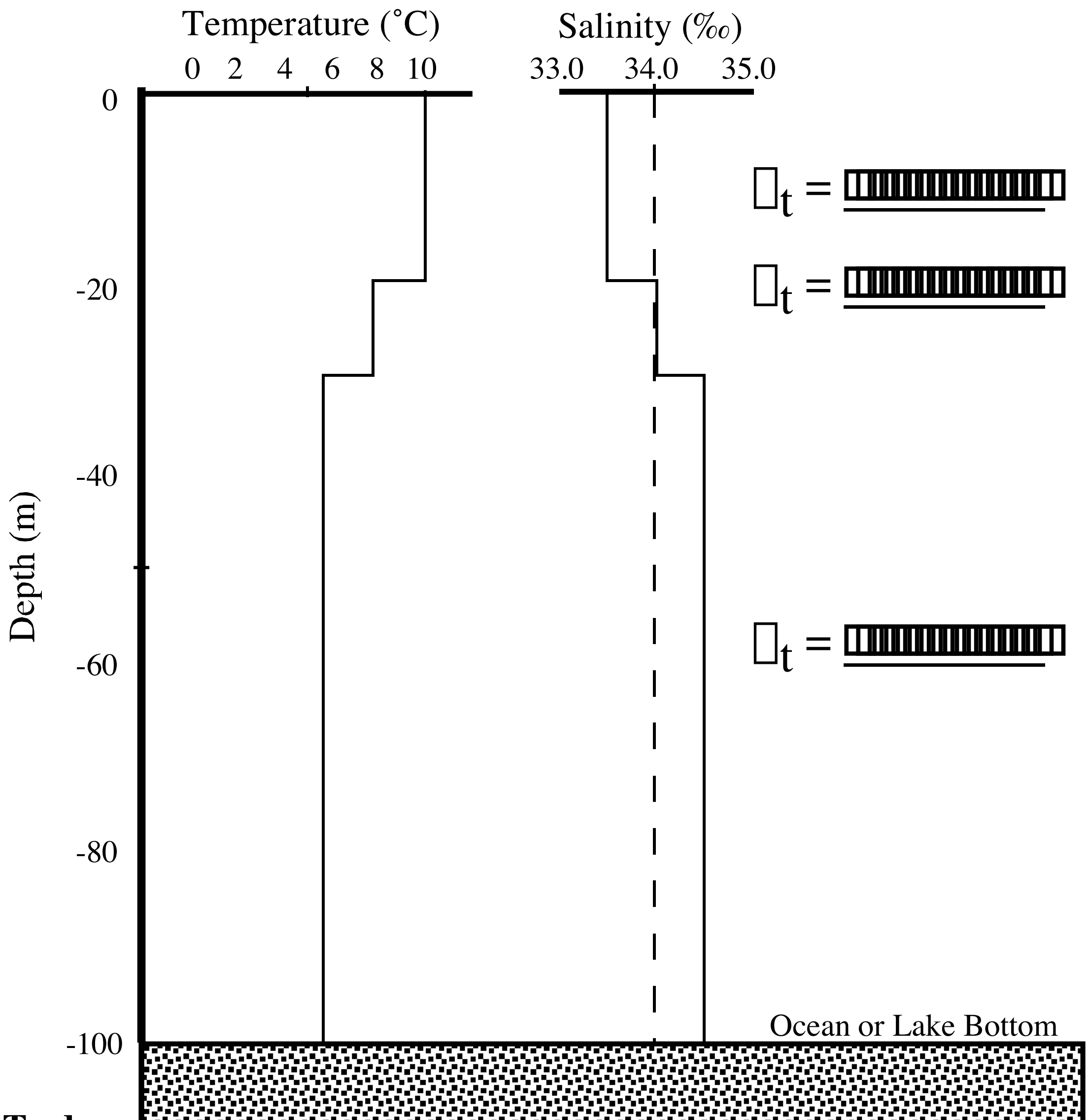
OC3230 Class Project 1

Name: ____________________

Prof. Paduan; Due Wed 24 January 05



To do:

1) Fill in values for **sigma-t** in each of the three density layers above defined by the solid profiles for T and S. Use MATLAB routine sw_dens0.

2) Assume the above temperature profile is in a fresh-water lake (S = 0‰). Calculate the amount of heat required in, Joules per m^2, to cool the upper 1m to the freezing point. Answer: ________ m^{-2}. How much more heat must be removed to actually freeze the upper 0.1m? Answer: ________ m^{-2}.
Assume: **specific heat** = 4000 J kg^{-1} ˚C^{-1}; Assume: **density** = 1000 kg m^{-3}.
Assume: **latent heat of fusion** = 335 x 10^3 J kg^{-1}.

Show your work on the back or on a separate paper.

3) Assume the above temperature profile is over a continental shelf with constant salinity (dashed line). Calculate the amount of heat required to cool the upper 1m to the freezing point. Answer: ________ m^{-2}. Assume the same value for specific heat as in 2) above (really it varies slightly with T and S). Assume: ρ = 1025 kg m^{-3}; **freezing point** = –1.9 ˚C.

(over)

4) Assume the above temperature profile and salinity profile (solid). Calculate sigma-t at the freezing temperature for the upper density layer.
Assume freezing point as in 3) above. Answer: ______ $m^3\ kg^{-1}$.
Calculate the amount of heat required to cool the upper 1m to the freezing point by assuming that only layer(s) that are less dense than the upper layer at its freezing point must be cooled. Assume specific heat is the same as that given in 2) above. Answer: ______ m^{-2}.
For simplicity, Assume: □ = 1025 kg m^{-3} as in 3) above when calculating the heating requirements. This illustrates the concept of **static stability**.

5) Use the MATLAB functions sw_dens0, sw_dens, and sw_svan to calculate the parameters below for a layer with S = 34.70‰, T = 2.45˚C, p = 2000db. Note: You must account for pressure effects in this case.

□$_t$ Answer: ______

□ Answer: ______

□ Answer: ______

□ Answer: ______

<u>Hints:</u>

Work with layers as defined in the figure.
Sum results for individual layers.
Write down appropriate units for everything.
Use MATLAB functions to answer specific volume anomaly and sigma-t questions but, for simplicity, use the constant density values given when computing heating (cooling) requirements (hint hint: you need to multiply by density).

In number 4) first determine how dense the upper layer will be at its freezing temperature and then determine how far down that water will sink when its cooled. Do the same for the next layer down and the next until you find that the layers are all less dense than some lower layer then cool only those upper layers.

Don't panic.